Range Effectiveness Evaluations 2004

Part 2. An Evaluation of Rangeland Health and Effectiveness of Plant Residue in Protecting Resource Values

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Abstract

A Ministry of Forests team evaluated a number of representative *Range Act* agreement areas in four forest districts during September and October of 2004. Agreements with range use plans approved after December 31, 2000 were given priority. Key areas, selected to be indicative of management and level of use, within primary range were evaluated.

Eighty-six sites were visited and the following data collected and analyzed: rangeland health (functionality), stubble heights, visual obscurity, browse utilization and form class, current and desired plant communities (seral stage), and invasive plant species. Digital photos were taken at each site.

Of the 69 uplands evaluated, 25 rated as Properly Functioning Condition (PFC) to slightly at risk, 13 rated as moderately at risk, and 31 rated as highly at risk to non-functional. Of the 7 wetlands evaluated, 3 rated as PFC to slightly at risk, 1 rated as moderately at risk, and 3 rated as non-functional. Of the 10 stream reaches evaluated, 2 rated as PFC to slightly at risk, 4 rated as moderately at risk and 4 rated as highly at risk to non-functional.

Sites rating as PFC or slightly at risk had later seral plant communities and higher average stubble heights than sites rating moderately at risk to non-functional. Plant community seral stage was a better predictor of site health than plant residue alone.

Target stubble heights for most sites are not adequate to protect resource values. Recommendations are made for increasing target stubble heights for some key forage species. The browse use level of 10% specified for most sites was typically exceeded, with use in excess of 40% common.

Poor livestock distribution continues to be a problem in many forested ranges. Stocking rates must be based on actual areas of use. In 100 Mile House Forest District, open grasslands and meadows continue to shrink in area from an encroaching forest community. This reduction is placing heavy grazing pressure on remnant grasslands and meadows, leading to overgrazing, short stubble heights, early-seral plant communities and poor site health. In most cases, adjacent Lodgepole pine/Douglas-fir forests are only lightly grazed, if at all.

The following steps could improve range health, productivity and wildlife habitat:

- Grazing pressure should be shifted from open grasslands and wet meadows to adjacent conifer forest for part of the grazing season.
- Ecosystem restoration should be implemented to create open forest with proper understorey layers.
- Mitigation should be required where forest harvesting has removed natural barriers adjacent to small streams.
- Rest-rotation grazing systems should be implemented on bunchgrass range.
- Both spring and fall use of a pasture unit should not be allowed in the same year.

The following are recommended to aid monitoring effects of livestock grazing:

- Small ungrazed reference sites are needed to provide site specific plant community comparisons in all pastures.
- Field inspections and monitoring rates should be increased based on an assessment of risk. Forest districts need to keep more complete inspection and monitoring records.
- Districts should implement a process of utilization mapping, seral stage mapping and functionality assessments on all range agreement areas.
- Range reference sites require detailed soils descriptions to serve as useful benchmark comparisons to similar grazed sites.

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Background

The *Forest Practices Code of British Columbia Act* (Code) came into effect in June of 1995 and required that all *Range Act* agreements have range use plans (RUPs). In September of 2000 substantial changes were made to legislation resulting in a restructuring of RUPs. The *Forest and Range Practices Act* (FRPA) came into effect on January 31, 2004 bringing further changes to range use plans. RUPs prepared under the Code were grandparented under FRPA and will remain in effect until December 31, 2006.

Rangeland health[1] is defined as the degree to which the soils and ecological processes of rangeland systems are sustained (Figure 1.). Range effectiveness evaluations strive to answer the following five questions:

1. Plant succession. Are range practices impeding desired plant succession?
2. Water/Hydrology Cycle. Are range practices impeding water cycle/hydrological function?
3. Mineral/Soils. Are range practices resulting in soils loss and/or degradation?
4. Energy (photosynthesis/production). Are range practices resulting in reduced quality and quantity of forage?
5. Wildlife and wildlife habitat. Are range practices resulting in a decline in the presence and abundance of wildlife?

Forest Practices Branch of the Ministry of Forests has the responsibility for developing legislation, policies and guidance governing livestock grazing on Crown rangelands. A review of published literature during FRPA development showed that plant residue was a key tool to protecting and conserving many resource values[2]:

- preventing soil erosion and building organic matter
- capture precipitation
- moderating soil surface temperature
- drought proofing soil
- establishing later successional species
- preventing weed invasion
- providing hiding cover for wildlife species
- promoting positive aesthetics and public perception

Stubble height a practical and meaningful surrogate measurement for plant residue on rangeland and domestic pastures[3]. Stubble heights have been a part of range tenure conditions since at least the 1960s. Range use plans typically have stubble heights limits or targets, but there are concerns among range managers with the adequacy of some stubble heights and with compliance.

Values in FRPA directly influenced by residue are biodiversity, fish habitat, forage and associated plant communities, soils, water and wildlife (including identified wildlife and ungulate winter range).

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[1] Source: Busbee, F.E. 1994. Rangeland Health. New methods to classify, inventory and monitor rangelands. NRC. Washington D.C.

[2] Fraser, D.A. 2003. A bibliography of stubble heights and utilization literature.

[3] Heady, H.F. and R.D. Child. 1994. Range Ecology and Management. Chapter 12. Utilization of Forage. Pages 169-187. Westview Press, Boulder Co.

In the 2004 range effectiveness evaluation the Range Section of Forest Practices Branch in co-operation with the Northern Interior Region (NIR) and Southern Interior Region (SIR) range staff evaluated stubble height (plant residue) and its effectiveness in protecting resource values and its relationship to rangeland health. The focus was on key areas or special management zones as identified in range use plans.

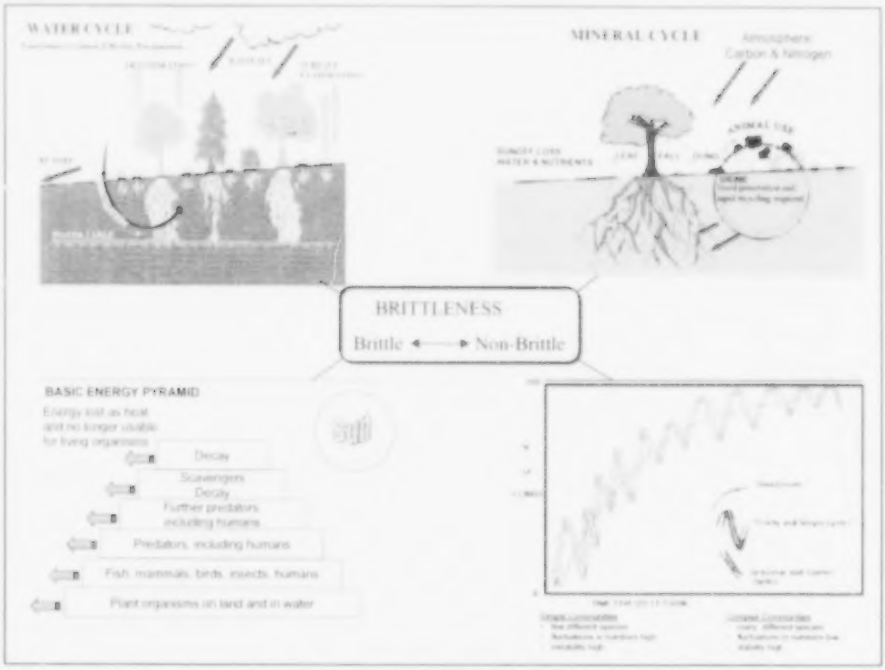


Figure 1 The ecosystem processes functioning in rangelands. Evaluating and monitoring of these processes is the best approach to ecosystem management.

(Source: Upland and Riparian Remedial Measures Primer. Range Section, Ministry of Forests)

Project Objectives

Evaluate a selection of range use plan areas across the province to determine if stubble heights are protecting resource values.

With a focus on primary range[4]:

- evaluate the health and functionality of uplands and riparian areas using standard methodology[5, 6];
- evaluate effectiveness of key areas and prescribed stubble heights[7] in the range use plan;
- report on the visual obscurity.

[4] Primary range. Areas that grazing animals prefer to use under the current management regime.

[5] Based on the USDI Bureau of Land Management methodology for assessing PFC. Don Pritchard, Workgroup Leader.

[6] Ministry of Forests. 1999. Range Resources Assessments Procedures. Version 1.2.

[7] Fraser, D.A. 2003. Applying Best Stubble Heights on rangelands. Ministry of Forests.

Methodology

A team evaluated selected range agreement areas in Peace Forest District and Nadina Forest District in the NIR and 100 Mile House Forest District and Okanagan-Shuswap Forest District in the SIR. Districts were selected based on the priorities and higher levels of risk as set out in Appendix 2. There was no attempt to make this a statistical survey.

Office component

A number of range use plans were selected from each district. Plans approved after December 31, 2000 were given priority. The range tenure file was reviewed to determine past use, monitoring records, utilization checks and compliance. The current management regime (grazing rotation, stocking rates, use levels) must have been in place for at least five years in order to evaluate effectiveness of the stubble height measures. The affected Forest District and agreement holders were advised by letter that the evaluation would take place.

Field Component

Teams visited selected pastures in selected plan areas and evaluated the residual cover, plant community and the health of the riparian areas and adjacent uplands in primary range. Doug Fraser of Forest Practices Branch was involved in all of the evaluations. Range Ecologists Laura Blonski and Rick Tucker represented their respective regions, with Laura participating in Peace and Nadina Forests districts and Rick participating in 100 Mile House of Okanagan-Shuswap Forest Districts. Where possible, district staff were in attendance during field evaluations to navigate and help in recording data. Exit interviews were conducted with the Forest District staff.

This was not a compliance audit. Situations of serious non-compliance with a plan's grazing schedule were referred to the District Compliance and Enforcement (C&E) staff for follow-up.

The following attributes were recorded at each site, preferably in key areas if they were identified, or in areas that were representative of the pasture unit. Information was recorded in ArcPad on a Trimble Recon handheld computer, with backup hardcopy data sheets. Global Positioning System (GPS) locations (in Universal Transverse Mercator (UTM) and Albers projections) were recorded for each site visited. Blank assessment checklists are in Appendix 1:

i) Functionality assessments

Site functionality is assessed using Ministry range assessment procedures[8].

Assessments are based on observations of the area attributes as listed in the checklists. For example, if an area has all or mostly all positive answers to the attributes on the checklist, it is deemed healthy, and at Proper Functioning Condition (PFC). If an area has few or no positive attributes on the checklist, it is deemed non-functional or at risk. An area is at risk (between 20--80% positive or yes attributes) when functioning at some level, but a combination of attributes make it vulnerable. A rating of slightly at risk (61--79%) may trigger some follow-up action such as more detailed monitoring or a change in management; or if an upward trend emerges, may verify that the management prescription is working. Riparian and upland systems rated as moderately at risk (41--60%) to non-functional (<20%) and having a downward or static trend will require remedial measures.

[8] Ministry of Forests. 1999. Range Resources Assessment Procedures. Version 1.2

ii) Stubble height measurements

Surveyors established a line transect and used a "point" sampling procedure. The surveyor walked a transect and at an interval of 5 paces, recorded the indicator grass or sedge species that lies closest to the toe of the right boot. Leaf length was recorded for each plant sampled and sorted by species. Depending on the uniformity of stubble height, from 20 to 80 measurements were taken along each transect.

Stubble height was reported as a minimum, maximum and an average for each indicator species. This assumes that under normal grazed conditions, there will be a patchy pattern of use with some plants grazed completely, some grazed moderately and some not grazed at all. This stubble height was compared to the minimum stubble heights criteria in the range use plans and to the recommended stubble heights tables in guidebooks.

iii) Visual obscurity (VO) measurements [9] [10]

In addition to the stubble heights measurements, 10 VO measurements are taken using a Robel pole along the same transect. A VO reading is taken every 20 paces.

A Robel pole is a modified surveyor's range pole, 3-cm in diameter and 120-cm in length. The pole is marked in alternating 2.54 cm (1") colored bands. Each band represents a VO reading of one . A 4-m cord is attached to the pole at a height of 1-m on one end and to a metre stick at the other end. This standardizes the distance and height at which readings are taken. One surveyor holds the Robel pole while another surveyor extends the cord and takes two readings along the transect line, following the ground contour. The reading or VO measurement is recorded as the highest band that is totally obscured. Readings are averaged at each location.

VO provides a good metric of hiding cover for ground nesting birds and small mammals. For example, sharp-tailed grouse and upland nesting ducks such as mallards and pintails need a VO reading of 8 for adequate nesting. Other smaller species require less cover, but a VO of < 3 is generally considered inadequate for most species.

iv) Browse utilization and form class

At each site a description of the major shrub species, an estimate of the current browse use and the browse form class (an indication of past use) was recorded.

v) Current and desired plant community descriptions

At each site current and desired plant community was described (by layers, by dominant and co-dominant species and estimated the current seral stage). Seral stage is defined as the plant community's similarity to the potential natural community (PNC)-climax, which is considered to be the site's potential. Seral stage categories have the following ranges:

	Early-seral	Mid-seral	Late-seral	PNC-Climax
% similarity to PNC-Climax	0-25%	25-50%	50-75%	> 75% climax

[9] Bureau of Land Management 1999a. Utilization studies and residual measurements. Interagency Tech. Ref. 1734-3.

[10] Bureau of Land Management. 1999b. Sampling vegetation attributes. Interagency Tech. Ref. 1734-4.

vi) **Invasive plant species**
Invasive plants were listed where found, and the size and distribution of the infestation recorded.

vii) **Photos**
Digital photos were taken at each site.

Results

A total of 86 sites were evaluated. The data were downloaded into an Access data base and a report was generated for each site. Digital photos were linked to each site visited. Report summaries and photos are in Appendix 3.

Okanagan-Shuswap Forest District

Twenty-eight sites were evaluated during seven days of field work. Results are summarized in Table 1.

Table 1 Numbers of uplands, wetlands and stream reaches by level of functionality in the Okanagan Shuswap Forest District.

	PFC ≥ 80%	Slightly at risk 61-79 %	Moderately at risk 41-60%	Highly at risk 20-40%	Non-functional < 20%	Total
Uplands	2	2	0	8	5	17
Wetlands	2	1	0	0	2	5
Stream reaches	1	1	2	0	2	6

Four upland sites that were rated as PFC and slightly at risk had average stubble heights ranging from 15 to 32 cm, with VO readings ranging from 0 to 8. These plant communities were rated as late-seral. In all cases palatable shrubs such as saskatoon, rose, snowberry, willow and snowbrush had received use in excess of 40% and browse form classes indicated this was an annual pattern of use.

Thirteen upland sites rated as highly at risk to non-functional generally had average stubble heights ranging from a low of 2 cm to a high of 22 cm, with VO readings ranging from 0 to 1.7. The site with a 22 cm average stubble height was judged to be recovering from historic heavy livestock use. Two sites rated as non-functional were lightly used by livestock and were recovering from logging and pocket gopher activity. In all areas grazed by livestock, palatable shrubs had been browed in excess of 40% of current year's growth and the browse form class indicated that this was an annual pattern. All of these plant communities were rated early-seral.

Five wetlands were evaluated. Trapper's Meadow and the large wetland in Mitchell Meadow were rated as non-functional and had been grazed heavily, with average stubble heights of 8 and 14 cm and VO readings of 0.6 and 1 respectively. Trapper's meadow was highly altered by livestock use and consequently the plant community had converted to bluegrass and Timothy. Mitchell meadow was damaged by ATV use. Browse use was high and shrub communities were compromised in both cases.

Three wetlands (a small wetland in the Mitchell meadow, Clier Lake and Goat Lake) rated PFC and slightly at risk. These were lightly used by livestock and had average stubble height of 50 cm, 27 cm and 60 cm and VO readings of 7, 5 and 12, respectively. Browse use was light to moderate.

Six stream reaches were evaluated. Two reaches were rated as non-functional. One of these streams had been trampled by livestock to the extent that above-ground flow had ceased. The plant community had converted to bluegrass and the average stubble height and VO readings were 2 cm and 0, respectively. Browse use exceeded 40% and the browse form class showed a continued pattern of heavy use. There were continuous patches of houndstongue along the riparian area. The second stream was free-flowing but was also badly damaged by livestock use. The plant community had been altered in the adjacent meadow and the shrub corridor was almost eliminated. Bluegrass averaged 10 cm in height, sedge was moderately grazed at 35 cm and VO readings were 4.5 in a narrow streamside riparian band that was about 4 m in width.

Two reaches of Charcoal Creek were rated as moderately at risk. This stream flows through a cutblock where no riparian buffer strip was left after logging. Downed woody debris restricts livestock access to the creek along most of its length, however where no barriers remain, livestock have trampled the creek and adjacent riparian zone. Browse use exceeds 40% of current year's growth.

Two streams rated PFC and slightly at risk. High water levels and beaver activity on Mitchell Creek restricted livestock access and use. Average stubble height and VO readings were 28 cm and 7 respectively. Fowler Creek, an interrupted channel, was lightly used by cattle although browse use ranged from moderate to high on snowberry and rose.

The Salmon Arm zone has identified key areas for monitoring purposes. These sites are representative and well chosen, making evaluations easier. The other zones did not have key areas as required by the legislation.

Range use plans generally follow stubble height criteria from the Range Management Guidebook (1995). However, many plans give conflicting messages by having general utilization tables in appendices that contradict stubble height and browse levels listed within the plan.

Livestock forage selectively and in a patchy manner grazing some plants severely, some moderately while leaving some grass plants untouched. Our measurements demonstrate that in order for the target stubble heights to be reached on average, a high percentage of plants would be grazed severely, thus compromising the health of the plant community. Observations indicate that these target stubble heights are too low to be sustainable and therefore higher figures are recommended.

Table 2 Target stubble heights in Okanagan Shuswap Forest District range use plans.

Species	RUP average (cm)	Recommended average (cm)
Bluebunch wheatgrass	12	17
Bluegrasses	8	10
Idaho fescue	8	15
Rough fescue	11	18
Pinegrass	8	18
Needle-and-thread	9	12
Wetland sedges	20	20

Over-utilized bunchgrass community

Moderately grazed bunchgrass community

Lightly used bunchgrass community

Heavily grazed riparian area

ATV damage to sedge meadow

A managed open larch forest with a healthy understorey

A spaced ponderosa pine stand with a healthy grass understorey

Stream and riparian area damaged by livestock use.

Other observations:

Pinegrass use is difficult to assess. Under forest canopy cattle tear it off at ground level, often leaving the area with the appearance of light use. This leads to an under-estimation of use and to a thinning of the pinegrass sward over time. Small ungrazed areas are needed as reference sites in order to evaluate livestock use. In openings such as cutblocks, however, cattle shear pinegrass leaving easily measured stubble.

Early-seral communities need to be grazed more conservatively in order to better protect soils, accumulate organic matter and allow recovery.

Rest-rotation grazing systems need to be implemented on bunchgrass range. For example, Crump pasture is showing a rapid decline in health due to heavy use plus a lack of planned rest.

Soil compaction was noted on nearly all grazed sites when compared to ungrazed exclosures.

Stubble heights are unenforceable as they are written in most of the range use plans reviewed. Key areas are needed in order to determine levels and acceptability of current use.

The district places a high priority on spending time in the field; however there was a lack of documented field assessments.

Nadina Forest District

Sixteen sites were evaluated during four days of field work. Results are summarized in Table 3.

Overall use was light and distributed well over landscapes. There were a few sites of localized overuse in grassland openings, in streamside riparian areas and in conifer plantations seeded to domestic fescue. Some seeded cutblocks remain as creeping red fescue monocultures.

Table 3 Numbers of uplands, wetlands and stream reaches by level of functionality in Nadina Forest District.

	PFC ≥ 80%	Slightly at risk 61-79 %	Moderately at Risk 41-60%	Highly at risk 20-40%	Non-functional < 20%	Total
Uplands	5	3	5	0	0	13
Wetlands	0	0	0	0	0	0
Stream reaches	0	0	2	1	0	3

Thirteen upland areas were evaluated.

Eight upland sites were rated as PFC or slightly at risk. They had average stubble heights ranging from 12.5 on one bluegrass site, to 22 cm on Canada reedgrass and blue wildrye. VO readings ranged from 0 to 1.7 because of lodging. Browse use was generally heavy on black twinberry, and moderate on rose, saskatoon and willow.

The five upland sites that rated as moderately at risk generally had lower stubble heights ranging from 8 cm (creeping red fescue) to 18 cm (bluegrass), with VO readings ranging from 0.3 to 0.45. Canada thistle and ox-eyed daisy were present on two sites. Browse use levels were moderate to high on palatable shrubs, with use exceeding 40% on black twinberry, saskatoon and rose.

Three stream reaches were evaluated. Two reaches rated as moderately at risk while adjacent riparian areas were over-utilized with browsing, breakage and rubbing impacts on shrubs. One reach of Boden Creek flows through a cutblock and is adjacent to private land. Livestock move from the cutblock into the streamside riparian area, cross the creek and bump up against the fenced private land. As a result, the area is over-utilized with an average stubble height of 6 cm on bluegrass. Current browse use was light; however the willow thicket has been broken and reduced by historic grazing. A small segment of Ramsay Creek was impacted by livestock use. Browse use exceeded 40% on black twinberry; however the adjacent upland was used moderately with an average stubble height of 20 cm on blue wildrye. Peace Creek and the adjacent upland area were lightly used by livestock. Peace Creek rated as slightly at risk, while its adjacent upland was PFC. Browse use was negligible to light.

No wetlands were evaluated.

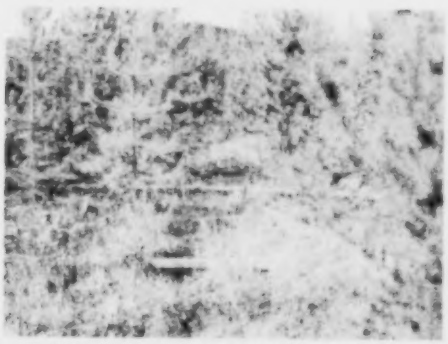
Most range use plans allow for very low target stubble heights that were much shorter than measured averages at monitoring sites. These stubble heights are well below recommendations in the Range Management Guidebook (1995) and other ministry guidelines. In order for target average stubble heights to be reached, a high percentage of plants would be grazed severely, thus compromising the health of the plant community. This makes the plans' enforceability questionable. Higher target stubble heights are recommended.

Table 4 Target stubble heights in Nadina Forest District range use plans.

Species	RUP average (cm)	Recommended average (cm)
Bluegrasses	3	10
Blue wildrye	7-10	15
Bluejoint	7-10	12
Creeping red fescue	3	8
Domestics	7-10	10

Heavily grazed plantation

Open south-facing slope



Lightly grazed plantation

A grazing exclosure

Other observations:

The district has used the provincial habitat monitoring guidelines[11] and established habitat monitoring sites on most agreement areas. Some sites, however, are no longer useful because of increased forest canopy closure. There is a need to establish more monitoring sites and to create some small reference sites that are free of livestock use.

[11] Procedures for Environmental Monitoring in Range and Wildlife Habitat Management. Version 4.1. Province of British Columbia. 1996.

Peace Forest District

Twelve sites were evaluated during five days of field work. Results are summarized in the following table.

An early season snowfall, with accumulations exceeding 50 cm, prevented evaluations in the Pink Mountain area and Cecil Lake Community Pasture. Several other sites were inaccessible because of poor road conditions and downed trees. Access was by foot in most cases resulting in fewer site evaluations during the week. Heavy snowfalls also made it infeasible to do visual obscurity measurements in many areas, since snow cover had lodged residual vegetation.

Table 5 Numbers of uplands, wetlands and stream reaches by level of functionality in Peace Forest District.

	PFC ≥ 80%	Slightly at risk 61-79 %	Moderately at Risk 41-60%	Highly at risk 20-40%	Non-functional < 20%	Total
Uplands	7	2	3	0	0	12
Wetlands	0	0	0	0	0	0
Stream reaches	0	0	0	0	0	0

Twelve uplands were evaluated. Nine were rated as PFC or slightly at risk. These were late-seral communities with average stubble heights and VO readings in wheatgrass-needlegrass communities ranging from 11cm to 36 cm and 3 to 6.3, respectively. Browse use was heavy on saskatoon and rose, and generally light on other shrub species. Browse form classes and current year's use indicate that the majority of browsing is occurring during winter when livestock are not on Crown range. In Canada reedgrass and hairy wildrye communities, stubble heights averaged, 11 cm to 39 cm, while VO readings could not be taken because of lodging. Browsing in these communities was generally light except that rose was browsed in excess of 40% on one site.

Three uplands were rated as moderately at risk. One site, a low vigour creeping red fescue pasture, had an average stubble height of 6 cm, a VO of 0, and browse use in excess of 40% of current year's growth. The second site, a mid-seral hairy wildrye community, had an average stubble height of 15 cm, a VO of 0 and light to moderate browse use.

The third upland site, a weedy early-seral community, had an average stubble height of 7 cm, VO of 0 and light to moderate browse use. These lower mean stubble heights indicate a pattern that has led to a decline in plant community vigour and site functionality. Browse use and form class indicate that browsing has been primarily in winter and therefore by wildlife.

VO measurements provide a good description of structure and plant vigour in wheatgrass-needlegrass-shrub communities of the Peace River and Beatton River breaks, that stubble alone won't provide. It is, however, time-consuming and infeasible in forested communities and in heavy shrub cover.

Sites in the Peace River breaks and Beatton River breaks showed signs of heavy wild ungulate winter use.

One site exhibited a reduction in saskatoon cover, evidence of repeated burning.

Range use plans generally follow stubble height criteria from the Range Management Guidebook (1995). Livestock forage selectively and in a patchy manner grazing some plants severely, some

moderately while leaving some grass plants untouched. Our measurements demonstrate that for target stubble heights to be reached, a high percentage of plants would be grazed severely, thus compromising the health of the plant community. Observations indicate that these target stubble heights are too low to be sustainable and therefore higher figures are recommended.

Table 6 Target stubble heights in Peace Forest District range use plans.

Species	RUP average (cm)	Recommended average (cm)
Bluejoint	10	12
Creeping red fescue	7-8	8
Hairy wildrye	11	12
Porcupine grass	9	12
Slender wheatgrass	9-10	15

A late-seral grassland-shrub community

An early-seral grassland community with poor cover

This plant community has been burned and grazed

A low vigour creeping red fescue seeding.

Other observations:

Range agreements have good inventories based on the work of contractors. All agreements have monitoring sites that were well chosen and representative. However, there is no record of assessments having been carried out by district staff. The district has set a target of visiting 10% of range agreements each year, meaning that an agreement area will be visited once during two range use plan cycles.

100 Mile House Forest District

Thirty sites were evaluated during four days of field work. The forest district arranged for a helicopter on the final day of the evaluations, greatly improving travel efficiency. Results are summarized in Table 7.

Table 7 Numbers of uplands, wetlands and stream reaches by level of functionality in Hundred Mile House Forest District.

	PFC ≥ 80%	Slightly at risk 61-79 %	Moderately at Risk 41-60%	Highly at risk 20-40%	Non-functional < 20%	Total
Uplands	3	1	5	9	9	27
Wetlands	0	0	1	0	1	2
Stream reaches	0	0	0	1	0	1

Four uplands were rated as PFC or slightly at risk. Two forested/pinegrass sites had stubble heights of 23 cm and 33 cm and VOs of 3 and 3.7; the first site had light browse use and the second exhibited heavy use of rose and saskatoon. Two sites were bluebunch wheatgrass communities with stubble heights of 18 cm and 11 cm and VOs of 1.4 and 0.3; both sites had negligible to light browse use.

Five uplands were rated as moderately at risk. All sites were early-seral communities dominated by bluegrass species (Kentucky bluegrass or alkali bluegrass). Stubble heights ranged from 3 cm to 12 cm and VOs ranged from 0 to 1.7. Browse use ranged from moderate to heavy where shrubs occurred.

Eighteen uplands were rated as highly at risk to non-functional. These sites were all early-seral communities dominated by bluegrass with in some cases mat muhly or inland saltgrass. Stubble heights ranged from 2 cm to 8.5 cm with most in the 4 cm range. VO readings were 0.3 at two sites and 0 at the remainder. Browse use, where shrubs occurred, was in excess of 40%. Bull thistle, dandelions, and goatsbeard were common.

Two wetlands were evaluated. One rated moderately at risk, had an average stubble height of 11 cm on sedges, a VO of 2.8 and browsing of willows exceeding 40%. The second wetland was non-functional, stubble heights averaged 7 cm on sedges, 4 cm on bentgrass, 12 cm on foxtail barley, with a VO reading of 0; trampling, bare soil and bull thistle were common.

One stream reached was evaluated and rated as borderline between highly at risk and non-functional. The stubble height averaged 4 cm on Kentucky bluegrass, VO was 0 and browse use exceeded 40%. There were continuous stands of bull thistle in the riparian area and the soil was compacted.

Most areas were in significant non-compliance with the target stubble heights in plans. We also noted numerous cases where livestock were in pastures several weeks (in one case two months) beyond the time allowed in the grazing schedule. This was reported to district C&E staff.

Records indicate a lack of inspections by C& E and Range staff in this district.

Target stubble heights varied noticeably from plan to plan and did not follow the suggested criteria from the Range Management Guidebook (1995) or Applying Best Stubble Heights (2003). For example, target stubble heights for bluegrass ranged from a low of 5 cm to a high of 10 cm; needlegrasses ranged from a low of 8 cm to a high of 12 cm; pinegrass varied from 8 cm

to 10 cm with a few going as high as 12 cm; sedges ranged from 10 cm in one plan to 20 cm in all other plans. Livestock forage selectively and in a patchy manner, grazing some plants severely, some moderately while leaving some grass plants untouched. Measurements demonstrate that for the target stubble heights to be reached, a high percentage of plants would be grazed severely, thus compromising the health of the plant community. Higher target stubble heights are recommended:

Table 8. Target stubble heights in 100 Mile House Forest District range use plans.

Species	RUP average (cm)	Recommended average (cm)
Bluebunch wheatgrass	12	17
Bluegrasses	5, or 6-7	10
Needlegrasses	8-10	12
Domestic grass	8	10
Orchardgrass	8	10
Pinegrass	8, 10 or 12	18
Saltgrass	6	8
Wetland sedges	10	20

Over-utilized open meadow

Livestock use has altered the plant community

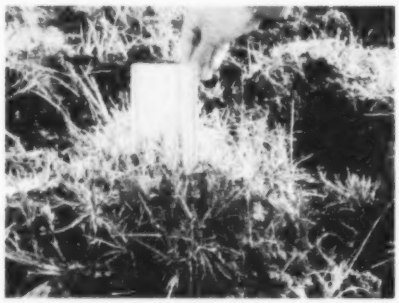
Over-utilized pinegrass with average stubble height of 5 cm

Lightly grazed open forest

Lightly used wheatgrass

Heavily grazed plantation

Trampled sedge meadow



Over-utilized sedge meadow with an average stubble height of 7 cm

Other observations:

The district uses special management areas to monitor range use. These were appropriately selected and made the task of monitoring easier. However the district lacks the resources to carry out field monitoring at even a 10% level. There is also a lack of C&E monitoring of range use as evidenced by numerous cases of cattle found several weeks out of grazing schedule rotations. Stubble heights and range readiness criteria should be set on only one or two key forage species in each special area.

Soil compaction is significant on most grazed sites.

Open grasslands and wet meadows are being lost to an encroaching forest boundary. This is placing increased grazing pressure on remnant grasslands, leading to overgrazing, reduced stubble heights, early-seral plant communities and poor site health.

In most cases, Lodgepole pine/Douglas-fir forests are lightly grazed, if at all. These forests are densely stocked with conifers, lack understorey species diversity and often lack appropriate grass species and entire shrub layers. Planned ecosystem restoration (e.g., thinning and burning) would restore desirable plant communities, enhance biodiversity and promote better quality wood fibre and forage for grazers.

Grazing pressure needs to be shifted from open grasslands and wet meadows to conifer forests for part of the grazing season. This may require development of new water sources, transport of water or more active herding of livestock to promote better livestock distribution.

Provincial Summary

Table 9 A provincial summary of the numbers of uplands, wetlands and stream reaches by level of functionality.

	PFC ≥ 80%	Slightly at risk 61-79 %	Moderately at Risk 41-60%	Highly at risk 20-40%	Non-functional < 20%	Total
Uplands	17	8	13	17	14	69
Wetlands	2	1	1	0	3	7
Stream reaches	1	1	4	2	2	10

Discussion

VO measurements provide an index of structure and plant vigour in grasslands and sedge meadows that stubble height alone won't provide. However, these measurements are time-consuming and infeasible in forested communities and in heavy shrub cover.

Soil compaction due to livestock was significant in 100 Mile House and Okanagan-Shuswap Forest Districts. Minor areas of compaction were noted in some riparian zones and cutblocks in Nadina Forest District. Soil compaction is often difficult to detect in the absence of livestock free exclosures. In 100 Mile House Forest District the difference in soil compaction within and outside exclosures was noticeable. Soils within exclosures were noticeably spongy to walk on and the Robel Pole was easy to stick into the soil, whereas in grazed areas, soils were hard and difficult to penetrate.

In 100 Mile House Forest District open grasslands and wet meadows are being lost to an encroaching forest boundary. This is placing heavy grazing pressure on remaining smaller grasslands, leading to overgrazing, short stubble heights, early-seral plant communities and poor site health.

Browse use and form class are useful tools for determining past and present use levels. Browse form class gives a good indication of past browsing. However, the species of ungulate responsible for the browsing is often difficult to determine unless the browse line is too high for cattle, or unless monitoring to detect cattle use occurs during the grazing season.

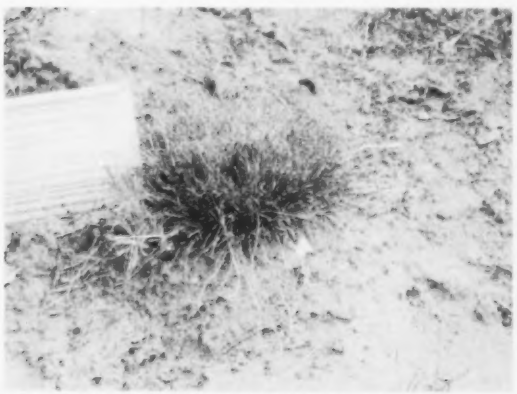
Certain shrub species are highly selected by cattle and are often the first to die out from a plant community layer. Woods rose, prickly rose, black twinberry, saskatoon, red-osier dogwood, snowberry and some species of willow are highly preferred by cattle. In particular, rose species, black twinberry and snowberry can be quickly eliminated from the plant community. Browse use levels generally exceeded the 10% level allowed in most range use plans with use in excess of 40% being common.

Plant community seral stage is a better predictor of overall rangeland health than plant residue alone. One year of over-utilization will not translate to a poor rating, however several years of over-use will cause a shift in plant species composition (to shallow-rooted, low growing grasses) and a change in functionality. Light utilization will eventually lead to recovery of the plant community and higher functionality ratings.

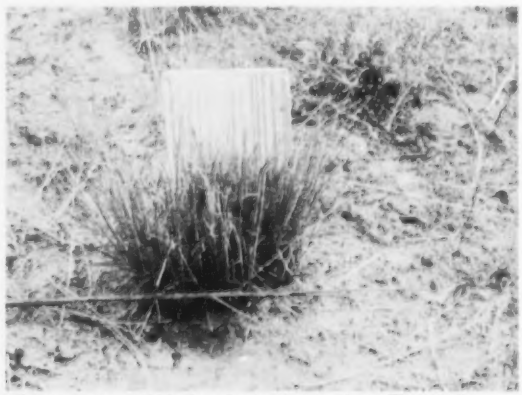
Stubble height measurements need to be sorted by key graminoid species in order to be useful. Table 10 has revised target stubble heights of key forage species.

Table 10 Target stubble heights for forage species in British Columbia.

Common name	Species name	Stubble height (cm)
Agropyron dasystachum	Northern wheatgrass	15
Agropyron spicatum	Bluebunch wheatgrass	17
Agropryon subsecundum and trachycaulum	Awned slender wheatgrass	15
Bromus spp.	Bromes	10
Calamagrostis canadensis	Canada reedgrass (bluejoint)	12
Calamagrostis rubescens	Pinegrass	18
Carex spp	Wetland sedges	20
Dactylus glomerata	Orchardgrass	10
Distichilis spicata	Inland saltgrass	8
Elymus glaucus	Blue wildrye	15
Elymus innovatus	Hairy wildrye	12
Festuca campestris	Rough fescue	18
Festuca idahoensis	Idaho fescue	15
Festuca rubra	Creeping red fescue	8
Phleum pretense	Timothy	10
Poa compressa	Canada bluegrass	10
Poa cusicki	Cusick's bluegrass	12
Poa juncifolia	Alkali bluegrass	10
Poa pratensis	Kentucky bluegrass	10
Stipa comata	Needle-and- thread	12
Stipa curtiseta	Western porcupine grass	12
Stipa spartea	Porcupine grass	12



An over-utilized Idaho fescue that has been grazed to about 6 cm in height. Proper use is 15 cm.



A properly grazed bluebunch wheatgrass plant. The middle portion of the plant has been grazed to about 13 cm, while the outer tillers are about 22 cm long.

Recommendations

1. Key areas are needed in all areas used by livestock to feasibly determine levels of use and range readiness.
2. Adopt more conservative stubble heights. Light to moderate utilization contributes to recovery of low seral plant communities and higher functionality ratings.
3. Adjust livestock stocking rates to actual areas of use.
4. Implement ecosystem restoration to create open forest with proper understorey layers.
5. Shift grazing pressure to conifer forests for parts of the grazing season. This may require the development of new water sources, transport of water and/or more active herding of livestock.
6. Mitigation is required where forest harvesting removes natural barriers adjacent to small streams.
7. Plant community inventories generally are not adequate and need to be brought up to the standard set in the Peace Forest District. A separate inventory file should be kept for each agreement area.
8. More C&E inspections are needed to ensure compliance with grazing schedules and levels of use.
9. Range monitoring should be based on an assessment of risk and ideally should take place on 30% of range agreements per year. Districts need to keep a better record of monitoring and field inspections.
10. Districts should implement a process of utilization mapping, seral stage mapping and functionality assessments on all range agreement areas.
11. Rest-rotation grazing systems should be implemented on bunchgrass range.
12. Both spring and fall use of a pasture unit should not occur in the same year.
13. Small representative ungrazed areas are needed in each pasture unit. These can be created by fencing, topography or by the felling some trees to create natural barriers to livestock movement.
14. Shrub layers need to be monitored more closely in forested communities and riparian areas.
15. Range reference sites require detailed soils descriptions to serve as useful benchmark comparisons to similar grazed sites.

Appendix 1 Excerpt from "The Range Resources Assessments Procedure"

How to use the function checklists

The checklists should be reviewed in advance of field work and any necessary file or historic information should be gathered and recorded at that time. Generally, you should get a feel of the area by walking a stream reach or traversing an upland area before filling in the checklists or forms; this will help to gain a broader perspective which otherwise may be lost if you become too concerned with making notes. Look for relic areas or areas where livestock use has been light in order to determine site potential

Use the field checklists in assessing for proper functioning condition (PFC) at the reconnaissance level. To qualify as functioning properly, riparian (including the feature) and upland areas must satisfy the general conditions outlined in Section 6 of this guide, and the answers to the majority of statements in the checklists must be "Yes".

An area is "at risk" when functioning at some level, but a combination of attributes makes it vulnerable. A score of "at risk" may trigger some follow-up action (e.g. more detailed monitoring or a change in management) or, if an upward trend emerges, may verify that the management prescription is working.

An area is "non-functional" when the criteria in Section 6 are not met and degradation is occurring.

The following table can be used to score the area being assessed. Pay particular attention to categories which give borderline answers as these indicate trend, and may serve as either early warnings or indicators of recovery in damaged systems.

% of Yes answers	Rating
Yes ≥ 80%	PFC
61-79%	Slightly at risk
41-60%	Moderately at risk
20- 40%	Highly at risk
Yes < 20%	Non-functional

Lakes, Ponds and Wetlands
Riparian Function Checklist

Range Unit:			Range Agreement Holder: Range Agreement Number:
UTM Coordinates::			
Name of Riparian-Wetland Area:			BEC Subzone:
Date:			Segment ID:
Classification of Lake or Pond:			
Type of Wetland (< 2m depth):			Marsh (beaver ponded; fresh water; saline; closed basin); Swamp; Bog; Fen; Shrub-carr
Observers:			
Yes	**No**	**N/A**	
			Hydrologic
			Water levels have remained unchanged over time (willow fringe or willow skeletons).
			Biotic/Vegetation
			The plant community is showing good vigour and maintenance of riparian soil moisture characteristics.
			Diversity and structure of the riparian and emergent vegetation has been maintained.
			The plant community is adequate to filter sediments and pollutants.
			Occurrences of trampling, rubbing or browsing are uncommon.
			Adequate vegetation cover is present to protect banks.
			A diversity of vertebrate and invertebrate life is evident.
			The riparian plant community is an adequate source of large woody debris, both now and for the foreseeable future.
			Erosion/Deposition
			Bank shearing, soil compaction, and bare ground are uncommon.
			Soil erosion and deposition in the wetland and riparian area are within natural levels.
			Hummocks are rounded and completely vegetated.
			Nutrient Inputs and Water Quality
			Nutrient levels are normal (there is a lack of algae mats and organism die-offs and there is a good aquatic species diversity).
			Inputs of fine organic matter are appropriate (leaves, small branches and twigs).

Check one

PFC ____

At risk ____

Non-functional ____

Notes:

Is the desired plant community present (diversity - - species comp., age classes, structure, form)?

Soils types and textures?

Are the riparian soils subjected to prolonged saturation and anaerobic conditions?

Is this wetland part of a beaver controlled riparian system?

Streams Riparian Function Checklist

Range Unit:			Range Agreement Holder: Range Agreement Number:
UTM Coordinates:			:
Name of Stream:			BEC Subzone
Date:			Segment/Reach ID: Gradient of Segment: Low, Medium or High
Stream type: Perennial, Intermittent or Ephemeral / Continuous or Interrupted			
Observers:			
Yes	**No**	**N/A**	**Parameters**
			Channel Structure, Function and Diversity
			Channel characteristics (rocks, large woody debris) and associated floodplain (access to overflow areas) are adequate to dissipate energy.
			Channel & banks are relatively stable.
			Lateral movement is associated with natural sinuosity.
			The segment is vertically stable.
			Erosion, deposition and movement of bed materials are normal for this reach.
			Bank shearing, soil compaction, and bare ground are uncommon
			Sinuosity, width/depth ratio, gradient, pool/riffle ratio, and other aspects of channel geometry are in balance with the landscape setting (e.g., land form, geology).
			Inputs of organic debris from adjacent riparian area and subsequent incorporation into the channel are normal for area.
			Banks are undercut.
			Riffle bed materials and gravels are free of sediment. Fish spawning and use of rock undersides by insects and other invertebrates are possible.
			Flow Regime
			Flow rates and timing remain unchanged over time (i.e. perennial to intermittent or ephemeral; continuous to interrupted)
			Biotic Community
			Roots of trees, shrubs, and grasses extend into the stream. Root masses are capable of withstanding high streamflow events and allowing formation of overhanging banks.
			The plant community exhibits high vigour and indicates maintenance of riparian soil moisture characteristics.
			Occurrences of trampling, rubbing or browsing are uncommon.
			Riparian plant communities are an adequate source of replacement woody debris, both now and in the foreseeable future.
			A diversity of vertebrate and invertebrate life is evident.
			Nutrient Inputs and Water Quality
			Nutrient levels are normal (there is a lack of algae mats and organism die-offs and there is a good aquatic organism diversity).
			Inputs of fine organic matter are appropriate (leaves, small branches and twigs).

Check one

PFC ____

At risk ____

Non-functional ____

Notes:

Is the desired plant community present (diversity - -species, comp., age classes, structure, form)?

Does the substrate make this stream susceptible to either vertical or lateral erosion?

Soils types and textures?

Are the riparian soils subjected to prolonged saturation and anaerobic conditions?

Is the stream beaver controlled?

Is the stream effluent or influent?

Have land uses altered the dynamics of the system?

Uplands Function Checklist

Range Unit:		Range Agreement Holder: Range Agreement Number:	
UTM Coordinates:			
Name of Upland Area:			BEC Subzone:
Date:		Location:	
Hectares:			
Observers:			
Yes	**No**	**N/A**	**Parameters**
			Hydrologic and Soils
			Organic material (plant litter, standing vegetation) protects soil surface from raindrop impact and evaporative effects of sun and wind.
			Water will easily infiltrate the soil surface (absence of physical soil crusting, capping).
			Subsurface soil conditions support infiltration (compaction layers are uncommon).
			Standing vegetation and plant litter detain overland water flow and trap sediment.
			Non-stream ephemeral drainages are stable (sufficient vegetation is present to protect against downcutting).
			Biotic/Vegetation
			The plant community is showing good vigour.
			There is recruitment of desirable plant species (new seedlings).
			The plant community reflects a fully occupied root zone.
			Seeps, springs, and ephemeral drainages support vigourous stands of phreatophytic plants.
			Biological breakdown of plant residues/organic material is apparent (decomposition as opposed to oxidization).
			Biological breakdown of livestock dung is rapid.
			A diversity of vertebrate and invertebrate life is evident.
			Erosion/Deposition
			Evidence of rills, gullies, pedestaling and other excessive soil movement is uncommon.
			There is little visual evidence of pedestaling of plants or rocks. Pedestals present are sloping or rounding and accumulating litter.

Check one

PFC ____

At risk ____

Non-functional ____

Notes:

Is the desired plant community present (diversity - - species, comp., age classes, structure, form)?

Soils types and textures?

Description of Plant Communities and Habitats

Browse utilization

List of preferred browse species on site	Browse Use Categories – current year's growth		
	Light – 0-10%	Moderate 11-40%	Heavy >40%

Lightly Browsed ☐ Moderately Browsed ☐ Heavily Browsed ☐

Current Plant Community

Desired Plant Community

Stubble Height

m transect. Measurements taken every paces.

Pattern of Use:

Measurements along transect:

Max. height ☐ Min. height ☐ Ave. height ☐

Max. height ☐ Min. height ☐ Ave. height ☐

Max. height ☐ Min. height ☐ Ave. height ☐

Max. height ☐ Min. height ☐ Ave. height ☐

Robel Pole Measurements

m transect. Measurements taken every paces.

Max: ____ Min: ____ Average: ____

Photo Number _____

Invasive Plants

Species: _____

Size of infestation:

<100 m² ☐ 10-2,500 m² ☐

>1 ha ☐

Distribution

Rare individuals ☐

Scattered patches ☐

Continuous stands ☐

Notes – (Plant community, structure, recruitment, litter, bare ground, invasive species)

Appendix 2 Priority setting within northern and southern regions

The following factors were considered when determining where to focus effectiveness evaluation. These are based on the levels of risk associated with livestock use of primary range.

Ecosystems/Plant communities

- resiliency to disturbance as determined by climate (moisture, growing season), soils and history
- types of vegetation and their disturbance regime
- plant community seral stage
- invasive plant species
- plantations that are not free growing

Range and livestock management

- Level of management and record of user
- Grazing system
- Numbers and classes of animals – concentration of animals
- Timing of use – related to soils moisture, precipitation, runoff events, and susceptibility of plants to damage by grazing, browsing or trampling

Riparian features

- Lower gradient streams with relatively broad floodplains flowing through fine textured sedimentary soils
- Systems that are dependent on vegetation and woody debris for stability (and in many cases beaver controlled systems)
- Where temperature sensitivity may be an issue
- Small, rare wetlands in dry ecosystems where water is a magnet for cattle and wildlife
- Fine textured soils where trampling may be an issue

Water quality

- Community Watersheds/Licenced Domestic Water Intakes

Wildlife

- Ungulate winter range grazed by livestock
- Wildlife Habitat Areas (WHAs) grazed by livestock
- Fish or identified wildlife concerns

Appendix 3 Summaries and Photos by District and Site

Okanagan-Shuswap Forest District

Nadina Forest District

Peace Forest District

100 Mile House Forest District